

1. Specify: agricultural project or individual application or
urban project joint application
2. Proposal title--concise but descriptive
**City-wide Irrigation Communication System
Rehabilitation**
3. Principal applicant--organization or affiliation
City of San Juan Capistrano
4. Contact--name, title: **David Hubler, Senior Parks Maintenance
Joe Mankawich, Associate Engineer**
5. Mailing address: **32400 Paseo Adelanto, San Juan Capistrano, CA 92675**
6. Telephone: **David Hubler, (949) 443-6365, Joe Mankawich, (949) 487-4313**
7. Fax: **(949) 493-3955**
8. E-mail: **dhubler@sanjuancapistrano.org, jmankawich@sanjuancapistrano.org**
9. Funds requested--dollar amount: 110,985
\$
10. Applicant cost share funds pledged—dollar amount: 12,400
\$
11. Duration--(month/year to month/year): **June 2001 to January 2002**
12. State Assembly and Senate districts and Congressional district(s) where the project is to be conducted:
The City of San Juan Capistrano is located in U.S. Congressional District 48, State Senate Districts 33 and 38, and State Assembly Districts 66 and 71.
13. Location and geographic boundaries of the project: **The project is located at 26 locations
throughout the City of San Juan Capistrano.**
14. Name and signature of official representing applicant. By signing below, the applicant declares the following:
-- the truthfulness of all representations in the proposal;
-- the individual signing the form is authorized to submit the application on behalf of the applicant;
-- the applicant will comply with contract terms and conditions identified in Section 11 of this PSP.

(signature of applicant)

B. Scope of Work

Executive Summary

The City of San Juan Capistrano, from the years 1989 to 1996, invested heavily into the new irrigation telemetry technology. The telemetry system, developed and sold by Motorola, allowed remote communication to irrigation controllers from either a central computer installed at the City Yard or from hand held mobile units. By being able to monitor and control irrigation times remotely and instantaneously, irrigation watering times for parks, roadway medians, facilities and landscape districts (some of the City's largest water users) could be swiftly reduced or shut off as required due to weather conditions, sprinkler head leaks or line breaks. The urban water conservation that can be expected by implementation of such a system is substantial. In San Juan Capistrano, the conservation of an average of 50 acre-ft. per year translates to an overall savings of 300 acre-ft during that 6 year time period.

Improvements began in 1989 with the installation of the central control unit. Satellite units at the City's parks and landscape districts were added from 1990 to 1996. Within a few years the City was seeing a respectable water use savings at its 26 telemetry controlled sites (please see attached map showing locations of the sites). Typical consumption savings exceeded 25% for every year as compared to usage prior to installation of the telemetry.

In 1997, Motorola sold the 800MHz Repeater Antennas used to transmit the radio messages to the irrigation controllers to Nextel, which closed down the 800 MHz system. Loss of this critical link rendered the City of San Juan Capistrano's vast system inoperable. The City's major investment in this new technology was now worthless.

Only after three years of struggling with no success to have Motorola and Nextel (offshoot company from Motorola which purchased and closed down the 800MHz system) restore the telemetry has the City hired a consultant to determine how best to resurrect the much needed irrigation communications. Loss of the system simply could not be tolerated any longer; the City was using (wasting) too much water. This grant request refers to the consultant's study as a basis to quickly and economically restore the system to its original function.

Statement of Critical Local Water Issues

CSJC-Water is highly dependent on imported water to provide the balance of its water supply. CSJC-Water primarily relies upon imported water purchases from the Municipal Water District of Orange County (MWDOC). The Eastern Transmission Main, the Tri-Cities Transmission Main and the South County Pipeline deliver imported water to its service area. Over 85 percent of the CSJC total water demand (combined domestic and non-domestic water systems demand) is met from imported water supply.

CSJC-Water has completed and adopted new Domestic and Non-Domestic Water Master Plans in 1999 and 2000, respectively. A primary CSJC-Water water resources planning objective is reduction of reliance on imported water supplies through development and utilization of local groundwater supplies. CSJC-Water's future water supply goal is a minimum 50 percent of combined domestic and non-domestic water demand will be supplied using local water supplies.

by the year 2010. Water conservation is a necessary component of the City's strategy to meet this goal.

Currently, demand for non-domestic water exceeds the available non-domestic water supply. As a result, more costly imported water supply must be used to supplement non-domestic water supply. Rehabilitation of the City's irrigation telemetry system is integral to the reduction of imported water use.

Nature, scope, and objectives of the project

The City of San Juan Capistrano requested that a study be performed relating to their existing Motorola IRRInet/Scorpio irrigation telemetry system and recommendations made to restore centralized remote control and monitoring to their city-wide irrigation control system. To that end Northern Digital Inc. performed an initial site visit on November 14, 2000, and further conversations have been conducted with various Motorola divisions and groups. The system issues that must be dealt with are outlined in the technical detail section of the Appendix. As an overview the consultant recommends the following improvements:

- Replacement of the existing obsolete radios with GM 300 type radios
- Replacement of existing Handitalkies
- Replacement of all existing 800 MHz antennas with 450-470 range antennas
- Testing of City owned radio frequency
- Central Control System Upgrades
- Irrinet control software upgrades
- Weather Station Interface
- Repeater Considerations

It is interesting to note that the existing weather station serves as a basis for water billing in the City of San Juan Capistrano, with tiered rates and allocations tied to ET and square footage of landscaped area. This system generates critical information for the City's entire customer base, when upgraded to accept the controller communications a more complete automation and further efficiencies will be expected.

Schedule

Please refer to attached Gantt Chart for the proposed project schedule. It is important to recognize that the City has already provided a consultant to assess the current system. Northern Digital Inc. has supplied the City with a comprehensive review and recommendations for the rehabilitation of the existing system. The design process is therefore in many respects complete and requires only minimal review and finalization to go to bid.

Monitoring and Assessment

The CSJC-Water Staff will monitor the water use by tabulating meter readings and assess the effectiveness of the telemetry system by reviewing and comparing data from the CSJC previous years water usage for the same locations. The CSJC-Water Conservation Coordinator is currently responsible for providing monthly reviews of records for all CSJC water meter readings. It is expected that savings similar to those seen when the system was operational will be achieved.

Outreach, Community Involvement, and Information Transfer

As the work required on this project is typically technical in nature the opportunity to employ workers from the disadvantaged areas of the community is minimal. Certainly all areas, including low income ones and the City's two tribal units, will benefit through this projects water conservation techniques. By lowering the City's demand on Metropolitan Water District imported water the City will be able to pass these savings down to the consumers.

Certainly savings of MWD water is paramount for the future development of San Juan Capistrano other cities within the District's domain. Any project that conserves the use of imported water positively impacts all agencies supplied by MWD.

Qualifications of the Applicants, Cooperators, and Establishment of Partnerships

David Hubler

Senior Maintenance Worker, City of San Juan Capistrano

Employed with the City of San Juan Capistrano for eleven (11) years. Assigned to the Landscape Division of the Public Works Department. Duties include:

Contract Administration for landscape maintenance, including special assessment districts, tree trimming, pesticide and eradication spraying.

Administration of Central Irrigation Control Systems (CICS) for purposes of good water management practices, due to increasing water rates and water availability/scarcity during drought periods.

Brief Background of CICS Experience: Field Operations and water management, development of infrastructure required for the Master Control Plan. Involved in all facets of a past Metropolitan Water District Grant that provided the City with eight additional field units, including site planning acquisition and installation.

Joe Mankawich

Associate Engineer, City of San Juan Capistrano

Employed with the City of San Juan Capistrano for two and a half (2 ½) years. Manager of the City's Public Works Capital Improvement Program for Parks, Open Space, Facilities, Vehicles and Storm Drainage. Contract Manager for various other City projects.

Employed with the City of Hermosa Beach for five (5) years as their Capital Improvement Program Engineer. Manager of construction for large sewer, storm drain, park, streetscape, pier and utility projects.

Employed with K&F Commercial Developers, Los Angeles, for six (6) years as a Construction Manager/Engineer. Managed construction and master planning of large retail centers and office buildings throughout the United States.

Budget Summary and Breakdown

The CSJC-Water Engineering Staff has prepared a budget breakdown and budget summary and economic analysis for the City-wide Irrigation Communication System Rehabilitation project. The budget breakdown and budget summary is divided into following three components:

- Section A CSJC staff and engineering consultant costs,
- Section B Project construction costs,
- Section C Operation and maintenance costs.

Table 1 presents the detailed budget breakdown and budget summary. The total of Sections A and B in Table 1 are the two components of the total capital cost for the project. As shown, the total estimated capital cost is \$10,757.

Section C of Table 1 contains annual operation and maintenance costs including estimates for power, staff operation and routine maintenance costs. The total estimated annual cost for maintenance is \$5000.

Budget Justification

Each acre-foot of water saved by the rehabilitated irrigation communications system will result in a savings of an acre-foot of imported domestic water purchased from MWDOC. Therefore, the City's current cost of imported domestic water or acre-foot of \$430 per acre-foot is used as the benchmark to determine whether the project is economically viable. If the sum of the project's amortized capital costs and annual costs are less than the City's cost for imported water, then the project will conserve water at a lower cost and is economically justified. If the sum of the project's amortized capital costs and annual costs are greater than the City's cost for imported water, then the project will conserve water at a lower cost and is not economically justified.

The telemetry system, in its earlier configuration, realized savings of 50 acre ft. or \$21,500 per year. Given that the telemetry system will have a 20 year useful life and the system is expected to pay for itself in less than 6 years this project very cost effective.

Benefit Summary and Breakdown

Implementation of this project will enable the City to realize a savings of at least 50 acre-feet per year of imported water supply purchased from MWDOC. The rehabilitated irrigation

communication system will be used to conserve irrigation demands of parks, homeowners' association common areas and commercial/industrial/institutional (CII) landscaped areas. It is hoped that the system can be gradually increased to include all city owned or maintained landscape areas.

Assessment of Costs and Benefits.

An economic analysis has been prepared to assess the costs and benefits of the City-wide Irrigation Communications System Rehabilitation project. Table 1 presents the details of the economic analysis. The following key assumptions have been made to prepare the analysis:

- The projected annual water conservation from the project is estimated to be 20,000 ccf. The CSJC-Water Engineering Staff believes that this assumption is a conservative estimate, considering the fact that the historical demand, as depicted on the graph entitled City of SJC – Landscape Use shows that these were the types of savings that the City had been realizing when the existing system was at its peak performance. The graph interestingly shows that in recent years there has been an increase of use even as the expected need was dropping. If projected forward the expected conservation would surely exceed the estimate used to calculate the project benefits.
- Sections A and B of Table 1 contain all estimated capital costs for the City-wide Irrigation Communications System Rehabilitation Project, including CSJC staff expenses, engineering consultant costs and construction costs. A 15 percent contingency is has been added to the total estimated capital cost.
- Capital costs are expressed in present value year 2000 dollars. Capital costs have been converted to annual cost amortized at 6 percent simple interest over 20 years.
- Section C contains all annual costs including the costs for power, staffing and routine maintenance.
- Page 2 of Table 1 presents the economic analysis for the City-wide Irrigation Communications System Rehabilitation Project. The total annual cost is \$15,757, including the amortized capital costs and the annual operation and maintenance costs. The unit cost of water conservation from the project is \$115 per acre-foot based upon the cost of imported water charged to the City of San Juan Capistrano by MWDOC. An even more favorable cost benefit could have been determined if we were to use the water billing price of \$544.50, rather than the MDOC charges of \$430.

TECHNICAL APPENDIX

1.0 RADIOS – IRRInet

There are two types of existing radios used with the IRRInet system. These are:

Motorola Maxtrac 800 trunking radios (F2711B)

Motorola Mostar (FLN1439A)

The Mostar radios are obsolete and cannot be converted to conventional radio operation. Although it is technically possible to convert the trunked Maxtrac 800's to conventional operation in the 800 MHz range, this is not advised, as the cost of conversion would approach the cost of a new radio. The result would be merely a converted 'old' radio. More importantly, it is not possible to convert Maxtrac radios to conventional operation and change frequency bands. The conventional Maxtrac line is being phased out at this time with GM300 type radios and so should be considered as a pending obsolete line. Additionally, the best and most common frequency range used for irrigation control is the low band UHF (450-470 MHz). It should be noted that there are possible secondary markets where 800 MHz trunking is still used such as Mexico where the old radios could be offered for sale.

Conclusion: If the irrigation system is to remain based upon Motorola hardware and software, replace all field radios (fixed and portable) with conventional 450-470 MHz radios. This includes the central control radio. One spare radio should be considered. All radios should be programmed for simplex operation i.e. one frequency for TX/RX as opposed to duplex operation i.e. separate TX and RX frequencies.

1.1 RADIOS – DTMF Handitalkies

If the revised irrigation system selected by San Juan Capistrano remains based upon Motorola hardware and software, the Motorola ICC Software will accept DTMF coded tones as a standard feature for maintenance and test purposes. The DTMF audio tones are intercepted from the Central Base Station radio and decoded to a data stream via a standard modem. The revised irrigation control system will NOT be able to make use of the existing Bramco DTMF decoder. In its place, a standard external modem is used with a special interface cable to the Central Radio microphone port. In addition, the existing handitalkies with DTMF capability must be replaced with non-trunked units compatible with the frequency to be used on the FIU to Irrinet links. If a non-Motorola system approach is selected, a separate DTMF radio receiver would have to exist at the central computer, as handheld spread spectrum radios with built-in DTMF keypads are not known to exist.

2.0 ANTENNAS

All existing 800 MHz antennas must be replaced with antennas matched for the final frequency chosen. As a matter of installation reliability the antenna feed lines should be inspected for any possible degradation, especially the RF connectors which may have had progressive moisture damage/corrosion. If budget allows, the recommended course of action is to replace the heliax feedlines, polyphaser and connectors at the same time that the antenna is replaced. After replacement of the antenna/feed line system, both forward and reverse power measurements must be made on the system. These results should be recorded for comparison against future yearly maintenance checks.

Antennas for the 450-470 MHz range are physically larger (1-2 Ft) than the present 800 MHz antennas. To minimize vandalism damage, antennas should be mounted high enough to be "out-

of-reach” such as on a utility pole or light standard so long as the FCC license limit of 30 feet is honored. If this is not possible, the IRRInet controller may be mounted in a fiberglass enclosure with the antenna also inside. Alternately, a whip antenna may be mounted inside a “dummy” 2” PVC pipe (perhaps disguised as a vent pipe) that would be mounted along side the existing enclosure.

3.0 RADIO FREQUENCY/LICENSE

The City already owns a valid FCC licensed frequency in the recommended range of 450-470 MHz. This license is:

FCC file number:	9807D111491
Call sign:	WPMP521
Tx	453.81250 MHz
Rx	453.81250 MHz

Since this frequency has not been actively used, it is recommended that a site survey be performed using a portable Motorola Radio Service Monitor to scan the local spectrum environment to assure that there will be no frequency interference. At this time a received signal strength (RSSI) test should be preformed in the frequency range of 450-470 MHz to determine the system fade margin and ultimate data transmission reliability. At this time it can be determined if an RF repeater site will be necessary. The Irrinet units cannot inherently perform store-and-forward functions. This frequency may be shared between the Irrinet and Scorpio protocols. If this is the frequency presently in use for the Irrinet to Scorpio link, then no changes to the Scorpio units will be necessary. Otherwise, the frequency crystal within each Scorpio must be changed.

If a non-Motorola replacement system is chosen, spread spectrum would offer the best performance/cost benefits. Spread spectrum radios require no operating license and are essentially immune to RF interference. In this case, spread spectrum radios would be used as the data link between the central computer location and the IRRInet locations. IF SPREAD SPECTRUM OPERATION IS CHOSEN, ALL IRRINET/SCROPIO UNITS MUST BE REPLACED WITH GENERIC PLCs. The fixed frequency listed above would still be required for use between IRRInet CPUs and their slave Scorpions and for possible use as the DTMF frequency.

A preliminary RF path study has been done as a portion of this project. These are theoretical path loss analysis studies for the following paths:

Central to Weather Station
Central to Escolar Parkway
Central to Acu Park
Central to Repeater Site

Repeater Site to Weather Station
Repeater Site to ACU Park
Repeater Site to Escolar Parkway

Of all locations listed, the path between Acu Park and the Central is of the greatest interest. This initial study indicates that a direct path should be possible. If handi-talkie communications are even marginally possible between these two sites, then data communications using high gain Yagi directional antennas will have a high confidence level. Conclusion: a data repeater should not be included initially but only if operational tests indicate un-reliable operation.

4.0 CENTRAL CONTROL STATION

Since computer technology has progressed by at least two orders of magnitude from the DOS vintage computer presently installed, it is recommended that the central control computer be replaced with a modern Pentium class machine. The new Motorola ICC Windows based software only requires a generic computer. Suggested specifications are:

- Pentium III, >450 MHz
- 64 Mb ram or greater
- 10 Gb hard drive or greater
- Windows NT or Windows 2000
- 56k Modem (if pcAnywhere operation is anticipated)
- graphics card capable of 1024 by 768 pixels or greater
- 17" monitor or greater
- 30 minutes UPS system to support the full computer
- Color ink jet printer for screen prints and general use.

Additionally, the existing field interface unit (FIU) must be changed to the current design for support under the new software. This is a NEMA 4 type enclosure, wall mounted.

5.0 MOTOROLA ICC (IRRIGATION CENTRAL CONTROL) SOFTWARE

The latest Motorola ICC software is for stand-alone operation. The software does not allow for economical linkage to other SCADA software systems. Attached are data sheets and user manual relating to the Motorola Windows based Irrinet control software. As the software is a different technology than the DOS based software that the City personnel are presently familiar with, training should be purchased with the final system. Additionally, all Irrinet CPU's and MIR5000 units must be upgraded for compatibility with the new central control software package. This involves internal EPROM replacement and minor circuit board changes.

The Motorola ICC software includes built-in paging features for alarms.

6.0 WEATHER STATION Interface

The existing Aqua Engineering weather station is compatible with the latest Motorola ICC software. However, a software upgrade from Aqua Engineering is required if automatic data gathering is desired. Otherwise manual entry may be used as is presently done.

Weather station data may be linked via the existing leased line and modem configuration or via spread spectrum radio modems to avoid the leased line monthly charges.

7.0 RF REPEATER Considerations

In the event that an RF data repeater proves to be necessary in the system, two options are possible.

Option 1 – Repeater added for fixed frequency repeating of data and DTMF functions between the Central Control and remote locations that have poor direct RF paths.

Option 2 – MDS spread spectrum repeater added for fixed selected repeating of data and DTMF functions between the Central Control and selected remote locations that have poor direct RF paths. The repeater site would use two MDS ratios (Master + Slave) in a back-to-back configuration. This would not be a general repeater but only repeat to selected slave MDS radios. This would not address operation of a maintenance DTMF handheld unit through this repeater.

TABLE 1

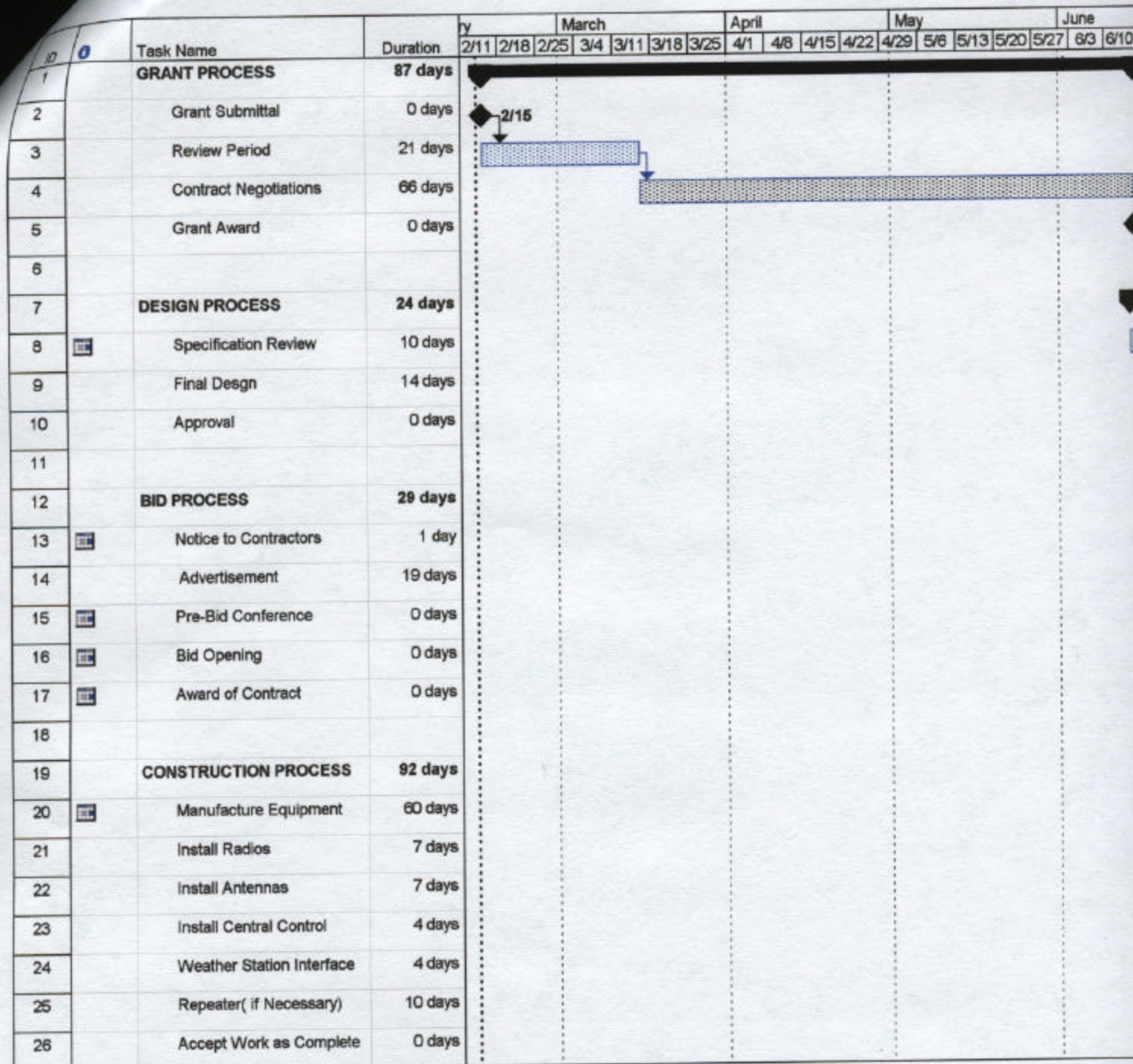
**CITY-WIDE IRRIGATION COMMUNICATIONS SYSTEM REHABILITATION
BUDGET BREAKDOWN, BUDGET SUMMARY AND ECONOMIC ANALYSIS**

CSJC Staff and Consultant-- Feasibility Study and Engineering Cost Estimate			
Line No.	Item	Quantity	Amount
A1.	CSJC Staff Hours & Expenses Cost		\$ 10,000
A2.	Engineering Consultant Budget		\$ 10,000
	Total CSJC Staff and Consultant Cost		\$ 20,000
Construction Cost Estimate			
Line No.	Item	Quantity	Amount
B1.	Irrinet Controller - Paseo Adelanto	1	\$ 2,000
B2.	Irrinet Controller - Village Road	1	\$ 2,000
B3.	Irrinet Controller - Fluidmaster	1	\$ 2,000
B4.	Irrinet Controller - Los Corrales	1	\$ 2,000
B5.	Los Corrales - Slave Scorpio	1	\$ 2,000
B6.	Irrinet Controller -Sports Park	1	\$ 2,000
B7.	Sports Park - Slave Scorprios	5	\$ 10,000
B8.	Irrinet Controller - Central FIU	1	\$ 2,000
B9.	F Units	20	\$ 40,000
B10.	Hand held w/ DTMF keypad	1	\$ 800
B11.	Upgrade F type MIR 5000 Firmware		\$ 5,000
B12.	Upgrade each Irrinet CPU to version 1.96		\$ 1,000
B13.	Computer Hardware		\$ 3,500
B14.	Central FIU		\$ 2,000
B15.	Motorola ICC Software		\$ 4,200
B16.	Documentation, Manual, Drawings		\$ 1,200
B17.	Miscellaeous Hardware/Cables		\$ 200
B18.	Scorpio& F Unit frequency changes		\$ 1,800
B19.	Weather Station Software Upgrades		\$ 5,000
B16.	Training		\$ 1,200
	Total Estimated Construction Cost		\$ 89,900
	Subtotal Estimated Capital Cost		\$ 109,900
	15% Contingency		\$ 13,485
	Total Estimated Capital Cost		\$ 123,385
Operation and Maintenance Cost Estimate			
Line No.	Item		Amount
C1.	Maintenance		\$ 3,000
C1.	Power		\$ 2,000
	Total Operation and Maintenance Cost		\$ 5,000

TABLE 1

CITY-WIDE IRRIGATION COMMUNICATION SYSTEM REHABILITATION (continued)

Economic Analysis			
	Amortization of Capital Cost		\$ 10,757
	(6% interest rate for 20 years)		
	Total Operation and Maintenance Cost		\$ 5,000
	Total Annual Facility Cost		\$ 15,757
	Annual Water Conservation (af/yr)		50
	Cost per Acre-foot of Water		\$ 315



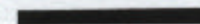
Project: CITY-WIDE IRRIGATION COMMUNICATION UPGRADES

Date: 2/9/01

Task

Split

Progress



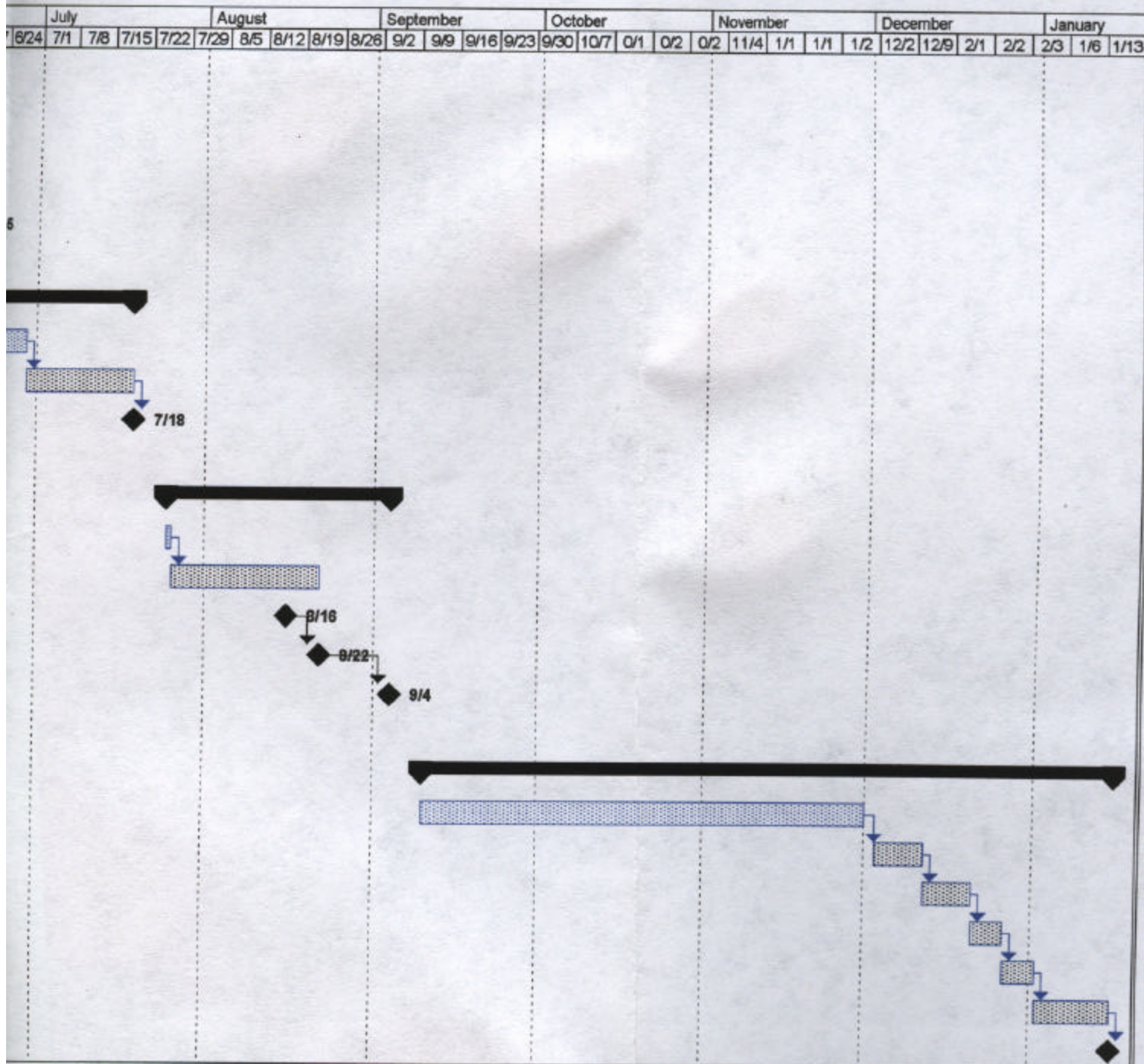
Milestone

Summary

Rolled Up Task



Timeline of Grades



Rolled Up Split

.....

External Tasks

Rolled Up Milestone

◇

Project Summary

Rolled Up Progress